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Fatigue as a biological setting event for severe problem behavior in autism spectrum disorder

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ABSTRACT

The relationship between biological setting events and problem behavior has thus far been described in only a limited number of empirical studies. We evaluated a three-step, multimethod procedure for the systematic assessment and treatment of fatigue as a biological setting event for problem behavior in three individuals with autism spectrum disorder and intellectual disability. The first step involved a descriptive analysis during which we identified individuals having a history of increased behavior problems when fatigued. The second step consisted of a functional analysis of each participant's problem behavior in relation to two contextual factors: fatigue and task demands. The third step evaluated the utility of a multicomponent intervention package designed to address both the biological context (fatigue) and psychosocial context (task demands). Results indicated that problem behavior was most likely to occur when both task demands (discriminative stimuli) were presented and when the setting event (fatigue) was operative. Implementation of a multicomponent intervention was associated with a dramatic reduction in problem behavior for all three participants. Implications for future studies examining the utility of the three-step procedure for understanding other biological setting events are discussed.

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1. Introduction

Problem behavior, such as aggression, self-injury, property destruction, and tantrums, commonly occurs in individuals with autism spectrum disorder (ASD) and has been a major focus of research due to its negative impact on quality of life (e.g., Koegel, Koegel, & Dunlap, 1996). Research has demonstrated that behavioral interventions for problem behavior are twice as likely to be effective if they are based on a functional assessment of the factors that evoke and maintain behavior than if they are not (e.g., Carr et al., 1999). Specifically, problem behavior has been demonstrated to be maintained by positive reinforcers, including attention (e.g., Carr & McDowell, 1980), tangible events (e.g., Durand & Crimmins, 1988), and sensory stimuli (e.g., Favell, McGimsey, & Schell, 1982) as well as by negative reinforcers involving escape from or avoidance of aversive stimuli (e.g., Carr & Newsom, 1985). In addition, antecedent variables such as task demands, whether presented in the classroom, vocational, or home setting, have frequently been observed to evoke severe problem behavior (e.g., Carr & Durand, 1985;

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Carr, Newsom, & Binkoff, 1980; Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991). Despite this knowledge, it is not always possible to identify the factors that predict and maintain problem behavior in individuals with ASD and other developmental disabilities (DD) (McGill, 1999). One explanation for this is that, sometimes, problem behavior may be controlled (at least in part) by internal or biological factors that are difficult to directly observe and measure, such as pain, illness, and fatigue (Carr & Smith, 1995). However, the literature examining the effects of fatigue on problem behavior is limited (e.g., Kennedy & Meyer, 1996; O'Reilly, 1995).

1.1. *The role of setting events*

While the presence of demands is predictive of problem behavior for some individuals, the degree of predictiveness is affected by another class of stimuli referred to as setting events. "Setting events" is the term given to a broad category of contextual variables that alter preexisting stimulus-response relationships (Bijou & Baer, 1978). Carr and Smith (1995) developed a model to illustrate the impact of setting events on problem behavior. This model brings together the three sets of controlling variables for problem behavior: antecedents (trigger stimuli), consequences, and setting events. Consider an antecedent stimulus such as a task demand (e.g., "Make the bed."). This stimulus may occasionally evoke an episode of problem behavior because, in the past, such behavior has led to removal of the putatively aversive demand (i.e., the individual is allowed to escape from the demand). However, the presence of a particular setting event may increase the likelihood that the antecedent will evoke problem behavior. For example, if the same demand is presented when the individual is fatigued (a setting event), the individual may be much more likely to display problem behavior. This is because fatigue may alter (increase) the aversiveness of the task demand, thereby strengthening the motivation for escape-related problem behavior (Michael, 1982). Research has increasingly demonstrated that internal or biological factors such as menstrual pain (Carr, Smith, Giacini, Whelan, & Pancari, 2003), ear infections (O'Reilly, 1997), physical illness (Carr & Owen-DeSchryver, 2007), anxiety (Moskowitz et al., 2013), and sleep deprivation (e.g., Kennedy & Meyer, 1996; O'Reilly, 1995) are associated with problem behavior and, in some cases, can even be setting events for problem behavior in individuals with ASD and other DDs.

1.2. *Fatigue as a setting event for problem behavior*

Previous research has shown that sleep problems are associated with increased challenging behavior in individuals with ASD (e.g., Adams, Matson, & Jang, 2014; Matson, Ancona, & Wilkins, 2008). However, fatigue is often defined as an internal and subjective feeling of tiredness (e.g., Hawley & Wolfe, 1997) or a "biobehavioral state" (Guess et al., 1988) that can be induced by a variety of factors in addition to sleep problems, including prolonged physical activity, temperature extremes, and a lack of sugar, salt, or water in the body. Although the relationship between fatigue and behavior problems has been suggested for populations with DD (Bailey & Pyles, 1989; Gardner et al., 1986), a formal means of examining this relationship and developing effective interventions has received limited attention in the literature. In a book chapter, Horner, Vaughn, Day, and Ard (1996) reported data for one individual with DD indicating that aggression was more likely to occur on days when the individual was fatigued. Although a functional assessment indicated that aggression on days when fatigue was reported appeared to be motivated by escape, these authors did not conduct an experimental manipulation of the hypothesized antecedent factor. In four studies related to the examination of fatigue as a setting event, O'Reilly (1995), Kennedy and Meyer (1996), O'Reilly and Lancioni (2000), and Horner, Day, and Day (1997) conducted functional analyses of the problem behavior for individuals with intellectual disability (ID) during conditions of sleep deprivation versus no sleep deprivation. The results of these studies indicated that sleep deprivation was associated with an increased frequency of problem behavior either during demands sessions (in the first three studies) or when the individual was prevented from obtaining a reinforcer (Horner et al., 1997).

However, in these studies, "sleep deprivation" was primarily defined and measured only in terms of amount of sleep (e.g., awake until 3:00 am, less than 5 h of sleep on a given night, missing an afternoon nap) rather than observable behavioral indicators of fatigue. In fact, none of these studies mentioned fatigue. Given that individuals with ASD and DD are often unable to communicate their internal states (e.g., they are unlikely to articulate, "I'm tired"), it often becomes necessary to identify fatigue based on observable behavioral indicators such as dazed facial appearance (Brazelton, 1984) or eyelids that appear heavy (Guess et al., 1988). Although Kennedy and Meyer also used "signs" of sleep deprivation (e.g., appearing drowsy when awake) in determining whether the setting event was present, they did not describe the procedures (e.g., direct observation, interview, questionnaires) used to assess for these signs. Finally, DeLeon, Fisher, and Marhekta (2004) found that a boy with ASD exhibited much higher rates of self-injurious behavior (SIB) within one hour after waking than all other times of the day. Experimentally manipulating scheduled awakenings substantially increased rates of SIB, supporting the relation between night-waking and SIB. Although the authors hypothesized that sleep disturbance functioned as an establishing operation to increase the value of escape, they did not identify the functional reinforcer (a functional analysis was inconclusive). In addition, while DeLeon et al. (2004) measured SIB, they did not mention "fatigue" or measure observable behavioral indicators of fatigue. Although both DeLeon et al. (2004) and Horner et al. (1997) successfully implemented interventions (i.e., faded bedtime, one-hour nap) to target problem behavior associated with awakenings or sleep deprivation, these strategies were not multi-component interventions designed to address the broader construct of fatigue in combination with the antecedent stimulus. O'Reilly (1995) implemented a multicomponent intervention to

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